

# TECHNICAL REVIEWERS' RATING SUMMARY

R005-A

## Phase I Biomass Enhanced Refined Lignite Demonstration Project

Great River Energy & ComPAKco, LLC

Principal Investigator: Norman Miller, ComPAKco

Request for \$275,000; Total Project Costs \$550,000

Rating Category	Weighting Factor	Technical Reviewer			Average Weighted Score
		<u>2A</u>	<u>2B</u>	<u>2C</u>	
		<u>Rating</u>			
1. Objectives	9	4	3	3	30.00
2. Achievability	9	2	2	4	24.00
3. Methodology	7	2	1	2	11.67
4. Contribution	7	4	3	2	21.00
5. Awareness	5	1	3	1	8.33
6. Background	5	5	3	3	18.33
7. Project Management	2	3	2	2	4.67
8. Equipment Purchase	2	4	3	3	6.67
9. Facilities	2	5	4	3	8.00
10. Budget	2	3	3	3	6.00
<b>Average Weighted Score</b>		156	127	133	<b>138.67</b>
<b>Maximum Weighted Score</b>					<b>250.00</b>

### OVERALL RECOMMENDATION

FUND

FUNDING MAY BE CONSIDERED

x

x

DO NOT FUND

x

R005-A  
Phase I Biomass Enhanced Refined Lignite Demonstration Project  
Submitted by Great River Energy & ComPAKco, LLC  
Principal Investigators: Norman Miller, ComPAKco  
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- 1. The objectives or goals of the proposed project with respect to clarity and consistency with North Dakota Industrial Commission/Renewable Energy Council goals are: 1 – very unclear; 2 – unclear; 3 – clear; 4 – very clear; or 5 – exceptionally clear.**

Reviewer 2A (Rating: 4)

The project will optimize the design and operation of the ComPAKer in blending lignite with biomass to produce a solid fuel. A fuel specification will be developed. Emissions testing will be conducted. If succeeds, it will be able to produce partially biomass-based solid fuels. This is consistent with ND renewable energy council goals.

Reviewer 2B (Rating: 3)

The goals of the project appear to be consistent with several of the goals of the REC. However, performance criteria or expectations expressed in terms of objectives should be provided. What are the investigators objectives as far as satisfactory product performance?

Reviewer 2C (Rating: 3)

The objectives of the Phase I study are: 1) to optimize design and operation of the ComPAKer in blending lignite with biomass, 2) to develop fuel specifications, and 3) to conduct emission testing.

The project objectives may be consistent with the NDIC/REC goals. However, the NDIC/REC goals are not specifically addressed as objectives. It is not clear how or to what extent the NDIC/REC goals can be met by successful completion of the project.

- 2. With the approach suggested and time and budget available, the objectives are: 1 – not achievable; 2 – possibly achievable; 3 – likely achievable; 4 – most likely achievable; or 5 – certainly achievable.**

Reviewer 2A (Rating: 2)

It seems the PIs have had experience in compacting biomass, but no information is given in the proposal about the product ComPAKer and its performance/sales; Nothing was discussed about how ComPAKer will be improved/changed/optimized for the proposed work; No preliminary results were given about recipes to show the feasibility of compacting lignite and biomass; No preliminary results were given to show the solid fuels might be able to meet furnace fuel specifications; No approaches were given for emission testing. Because of these, I am not convinced that the project will be successful, although it is possible.

Reviewer 2B (Rating: 2)

The budget appears to be adequate; however, there are a lot of unknowns with respect to system design, protocol designs, testing protocols and arrangement of cooperative agreements with

home and small furnace manufacturers that need to occur in a relatively short period of time in order to complete this project as proposed.

Reviewer 2C (Rating: 4)

The Phase I objectives will most likely be achieved because specifications and goals on process operation, product quality, emissions, product quantity and operating efficiency are not quantified. The criteria for success are very subjective.

- 3. The quality of the methodology displayed in the proposal is: 1 – well below average; 2 – below average; 3 – average; 4 – above average; or 5 – well above average.**

Reviewer 2A (Rating: 2)

This proposal really did not disclose any technical information, except saying that it will follow a previous design and several patents are pending. The previous design (ComPAKer) was not discussed in the proposal.

Reviewer 2B (Rating: 1)

The proposal indicates that the product design and protocol will be developed by June 1; System design will be completed June 2009. Test burn protocol will be developed by August 1. Expectations/estimates of final product heating value and moisture content have not been provided. Does the collected biomass need to be dried also prior to mixing with the beneficiated lignite? There is little methodology provided to evaluate.

Reviewer 2C (Rating: 2)

The quality of the methodology is below average. Inclusion of project management tools, product quality goals, product and emission specifications and engineering design consideration for testing multiple factors would improve the methodology and the overall project.

- 4. The scientific and/or technical contribution of the proposed work to specifically address North Dakota Industrial Commission/Renewable Energy Council goals will likely be: 1 – extremely small; 2 – small; 3 – significant; 4 – very significant; or 5 – extremely significant.**

Reviewer 2A (Rating: 4)

The idea of blending lignite with biomass to produce solid fuels is novel. The technology will be important to promote renewable energy. I would give a rate of 5 if the PIs showed the potential significant impact of the technology, that is, to estimate how much biomass will be used to bring benefits to farmers.

Reviewer 2B (Rating: 3)

This project may answer some important questions related to the possibilities of a lignite/biomass solid fuel.

Reviewer 2C (Rating: 2)

The scientific and technical contribution of the proposed work will likely be small. Briquetting, pelletization and binders have been studied extensively. It is not clear that any scientific or

technical advantage exists with biomass/lignite blending. It is not clearly shown that any new breakthrough exists or can be accomplished as a result of the proposed study. If the work is confidential, then it is less likely that any scientific or technical contribution will evolve.

**5. The principal investigator's awareness of current research activity and published literature as evidenced by literature referenced and its interpretation and by the reference to unpublished research related to the proposal is: 1 – very limited; 2 – limited; 3 – adequate; 4 – better than average; or 5 – exceptional.**

Reviewer 2A (Rating: 1)

The PIs did not discuss any current research activities in the field of biomass binding/processing/densification/utilization. One example is extrusion, which can have similar function of compacting biomass; Another example is combined heat and power generation from biomass-coal plants. A lot research has been done in testing biomass in coal power plants; One more example is testing of solid fuels in furnaces.

Reviewer 2B (Rating: 3)

Great River Energy has good experience with beneficiated coal; but, based on the qualifications indicated in the proposal, GRE has limited experience with biomass other than “it is currently evaluating the feasibility of utilizing biomass as a fuel for the Spiritwood Station.” No “specific” biomass experience is mentioned or references to current literature are made with respect to ComPAKco or GAE. It is stated Norm Miller of ComPAKco has “extensive biomass experience”, but there is no reference or examples cited to any of his experience. It is only because of GRE's experience with beneficiated coal, that I would rate PI's awareness of research activity and published literature as high as “adequate”.

Reviewer 2C (Rating: 1)

I gave the proposal a one (1) because zero (0) was not an option. There is no reference to published or unpublished literature or current research activity outside the purview of the proposal team.

**6. The background of the investigator(s) as related to the proposed work is: 1 – very limited; 2 – limited; 3 – adequate; 4 – better than average; or 5 – exceptional.**

Reviewer 2A (Rating: 5)

The PIs are qualified to conduct the proposed work, if they are already in the business of ComPAKer.

Reviewer 2B (Rating: 3)

Same comments as in 5. Above.

Reviewer 2C (Rating: 3)

The backgrounds of the investigators are adequate to perform the proposed work.

- 7. The project management plan, including a well-defined milestone chart, schedule, financial plan, and plan for communications among the investigators and subcontractors, if any, is: 1 – very inadequate; 2 – inadequate; 3 – adequate; 4 – very good; or 5 – exceptionally good.**

Reviewer 2A (Rating: 3)

The PIs are clear about the roles of their team members, however, the timetable/tasks/milestones can be more clear. The sequences of the tasks are not well-thought.

Reviewer 2B (Rating: 2)

Milestone chart/schedule is clear, but certainly not much detail is provided on page 13. The project management plan is inadequate. It is stated “a variety” of biomass products may be tested. For example, what biomass products? How is the biomass and refined lignite going to be combined? Who will be conducting the emissions testing? The communications plan is not clear. The chart shown on page 12 does not indicate the project interaction, lines of communication or chain of command on this project between GAE, GRE and ComPAKco.

Reviewer 2C (Rating: 2)

The project management plan is inadequate for a \$275,000 request.

- 8. The proposed purchase of equipment is: 1 – extremely poorly justified; 2 – poorly justified; 3 – justified; 4 – well justified; or 5 – extremely well justified. (Circle 5 if no equipment is to be purchased.)**

Reviewer 2A (Rating: 4)

Most of the equipment to be purchased or leased are common and are needed. Will the ComPAKer be an in-kind product? The budget is not well justified.

Reviewer 2B (Rating: 3)

The purchase of equipment is documented; not well justified, but, not poorly justified.

Reviewer 2C (Rating: 3)

Equipment purchase and lease are identified as budget items. Details concerning individual purchases and leases are limited.

- 9. The facilities and equipment available and to be purchased for the proposed research are: 1 – very inadequate; 2 – inadequate; 3 – adequate; 4 – notably good; or 5 – exceptionally good.**

Reviewer 2A (Rating: 5)

The facilities and equipment are common.

Reviewer 2B (Rating: 4)

It appears the project investigators know well, and have indicated, what equipment is necessary, available and needs to be purchased.

Reviewer 2C (Rating: 3)

The facilities and equipment available or to be modified in Fargo are adequate.

**10. The proposed budget “value”<sup>1</sup> relative to the outlined work and the financial commitment from other sources is of: 1 – very low value; 2 – low value; 3 – average value; 4 – high value; or 5 – very high value. (See below)**

Reviewer 2A (Rating: 3)

My concern with the value of the proposed work is whether the PIs will or will need to improve/optimize their current equipment ComPAKer. Since the focus of the proposed work is to optimize a current equipment for a different end product, PIs should have shown in the proposal that why they need to and how they will change their design. If current equipment (ComPAKer) does not need to be changed, the proposed work will just be the testing of the solid fuels and the value will be limited.

The project seems like a feasibility study. A feasibility study has limited value.

Reviewer 2B (Rating: 3)

In the proposed budget, it is not clear as to what GAE, GRE and ComPAKco each are providing in terms of cash and in-kind services. Will the cost of collecting biomass be factored into the lignite/biomass product? It is stated on page 5 and on page 9&10 that the refined coal from the Falkirk mine will be similar in heating value to subbituminous coal. It is my understanding that the coal beneficiation process will increase the Falkirk lignite from about 6300 Btu/lb to about 7200 Btu/lb. Switchgrass and wheat straw have a heating value of about 7000 Btu as received. The heating value of dry switchgrass and straw is about 8000 Btu/lb. Power River Basin subbituminous coal is between 8000-9000 Btu/lb. What do the project investigators expect the heating value of the lignite/biomass project to be? This expectation is not provided in the proposal. It appears there is \$2 (cash and in-kind combined) for every \$1 requested of the NDIC; this is a “plus.” However, I am skeptical that this product will be economical when including the costs of collecting and processing the biomass component of this product. Therefore, I’m also skeptical that this lignite/biomass fuel product will be able to displace subbituminous coal used in smaller boilers and furnaces. In a study conducted by UniField Engineering, “Potential for Co-Firing Biomass in North Dakota Power Stations (April 2007),” it was indicated that the cost of co-firing up to 5% biomass in North Dakota power stations was estimated to range from \$60-\$70 per million Btu of biomass at the burner tip. Whereas, the cost of firing lignite is between \$1-2 per million Btu. Despite these questions and reservations, there may be value in the learning more about the possibilities of this lignite/biomass product to determine the true potential.

Reviewer 2C (Rating: 3)

The proposed budget is of average value. The research could be accomplished at other regional research centers for comparable NDIC/REC costs and with prospects of additional funding participants and expertise.

<sup>1</sup> “Value” – The value of the projected work and technical outcome for the budgeted amount of the project, based on your estimate of what the work might cost in research settings with which you are familiar.

**10a. Financial commitment from other sources – A minimum of 50% of the total project must come from other sources to meet the program guidelines. Higher priority is to be given if the application has private industry investment equal to or at least 50% or more of total cost.**

**The minimum 50% cash match is demonstrated.**

### **Section C. Overall Comments and Recommendations:**

**Please comment in a general way about the merits and flaws of the proposed project and make a recommendation whether or not to fund.**

#### **Reviewer 2A (Funding May Be Considered)**

The proposed work is important in that it will produce partially biomass-based solid fuels to replace coal.

I was looking for information about their current equipment ComPAKer in the proposal because it is crucial to the success of the proposed project. Unfortunately, the PIs did not disclose any performance/sales/design information about it. I believe this is the major flaw of this proposal.

I also want to be assured that the PIs meant to change/optimize their equipment ComPAKer, that is, they should have shown why and how they will make changes.

The PIs did not show any preliminary data to convince me that lignite can be bound with hay, and the fuel might be able to meet furnace fuel specifications. This will be important to have if the proposal will be funded or resubmitted.

#### **Reviewer 2B (Funding May Be Considered)**

The amount of detail regarding methodology, coordination/communication and project management was deficient in order to convince me that this project has been sufficiently planned. I am skeptical that this product will be economical (cost competitive) when including the costs of collecting and processing the biomass component of this product. It appears to me that this product has some potential if the economics of this product as a fuel can be related to the mitigating factors of CO2 management costs associated with the biomass component of the fuel; and, show value as a cost-effective greenhouse gas mitigating strategy. If so, this project and product may have more potential as a cost-effective fuel. Overall, there may be value in the learning more about the possibilities of this lignite/biomass product. My recommendation is “funding may be considered.”

#### **Reviewer 2C (Do Not Fund)**

There is insufficient information in this proposal to recommend anything but, “Do Not Fund”. Transparency is a cliché often used to describe goals for decision-making in many disciplines. This proposal is opaque to this technical peer reviewer. The engineer and scientist are trained to make decisions based on information and data quantified through testing, analysis and cited

reference sources. Numbers, values, quantification of goals, tables, and graphs are forms of documentation the scientist and engineer seek for transparency. These forms of documentation are missing from this proposal. Many questions remain unanswered including but not limited to the following:

1. What are the ultimate and proximate analyses of the refined lignite?
2. What are the ultimate and proximate analyses of the biomass?
3. What are the target chemical specifications for the blended fuel?
4. What are the target physical specifications for the blended fuel?
5. What are the technical, economic and environmental advantages of the blended fuel?
6. What is the market size of Wyoming subbituminous coal in North Dakota?
7. What is the quality of the delivered Wyoming subbituminous coal in North Dakota?
8. What economic and technical advantage exists for the Wyoming subbituminous coal user to switch to the blended fuel?
9. Are blended fuel product quality goals designed to minimize capital and operating cost requirements to accommodate fuel switching?
10. Was the previous ComPAK project recommended for funding by NDIC/REC? Was the project completed successfully? What were the results and conclusions from the previous studies?
11. If Phase I has a total cost of \$550,000 with a request for \$275,000, then what will be the costs and request for Phase II and future development?
12. What would be the carbon footprint advantage of the blended fuel to North Dakota expressed in terms of lbs or CO<sub>2</sub> / MMBtu and total tons of CO<sub>2</sub> /yr in North Dakota? All comparisons should be on full energy cycle accounting.
13. What is the project and blended fuel incentive for North Dakota in terms of increased jobs and economic activity?
14. What is the incentive for North Dakota in terms of state tax revenues?

This may be a great proposal. However, the opaque nature of the proposal results in too many unanswered questions to warrant a positive recommendation from a scientific and technical perspective.